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Assessment of Influences of Stenoses in Right Carotid Artery on Left Carotid Artery Using Wall Stress Marker

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Abstract

© 2017 Arindam Bit et al. Purpose. Atherosclerosis is a diseased condition of blood vessel. It causes partial blockage in lumen of vessel and affects hemodynamic of localized flowing blood. Complex geometries like region of bifurcation also affects hemodynamic to a larger extent. Complexity further increases in presence of stenoses at region of bifurcation. Such morphological change in vessel largely affects parent as well as corresponding sister and daughter vessels. In this paper, complexity in hemodynamic of blood in pair of carotid arteries (left and right carotid arteries) is evaluated in presence of stenoses at basilar segment of right artery in three-dimensional domain using reconstructed tomographic images of patient. Methods. Transient information of blood flow is obtained using four-dimensional phase-contrast MRI technique. Haematocrit component of blood at diseased condition is considered using Power Law and Quemada model. Numerical techniques are used to solve pressure-coupled governing equations of flowing blood. Results. Dysfunctions of endothelial cells near the wall are characterised by evaluating shear stress markers. Wall shear stress and its gradient based and harmonic based descriptors are calculated over complete geometry during one cardiac cycle. Conclusion. Internal branch of left carotid artery and external branch of right carotid artery are found prone to secondary stenoses in presence of primary stenoses at basilar segment of right carotid artery.

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